AMENDMENTS TO THE SPECIFICATION

*Page 1, immediately after the title "**MOORING SYSTEM WITH ACTIVE CONTROL**" please insert the following:*

Related Applications

This application is a national phase entry in the United States of the International Application PCT/NZ2003/000167 filed July 30, 2003 and claims the benefit of the New Zealand Application 520450 filed July 30, 2002.

Background of the Invention

Page 4, please amend the paragraph beginning on line 8 as follows:

Accordingly in a first aspect the ~~present~~ invention ~~consist in~~ includes a method of controlling a vessel mooring system said system including at least one mooring robot for releasably fastening a vessel floating at the surface of a body of water to a terminal, the mooring robot including an attractive force attachment element displaceably engaged to a base structure of said mooring robot said base structure affixed to said terminal, said attractive force attachment element being releasably engagable with a vessel surface for making fast the vessel with said terminal, the mooring robot providing active translational movement of the attractive force attachment element relative to the base structure to allow thereby the movement of a vessel in a direction from any one of both of

Page 6, please amend the paragraph beginning on line 8 as follows:

Preferably wherein the force(s) measured in (b) between the attractive force attachment element and the base structure is continuously monitored and determined from a signal responsive to a transducer, wherein said signal responsive to said transducer is displayed on the vessel visually, to indicate the force(s) between vessel and said fixed structure of said ~~mooing~~ mooring robot.

Page 6, please amend the paragraph beginning on line 13 as follows:

Preferably said system included a plurality of spaced apart mooring robots, each presenting an attractive force attachment element to engage to a surface of said vessel and wherein the force(s) as measured in (b) between the attractive force attachment element and the base structure of each mooring robot is continuously monitored and determined from a signal responsive to a transducer, wherein said signal responsive to said transducer is displayed on the vessel visually, to indicate the force(s) between vessel and said fixed structure of said ~~mooing~~ mooring robot.

Page 8, please amend the paragraph beginning on line 30, and continuing on page 9, as follows:

Accordingly in a second aspect the ~~present~~ invention ~~consists in~~ comprises a vessel mooring system which includes

Page 9, please amend the paragraph beginning on line 18 as follows:

(a) ~~a~~ means to measure the attractive force between the attractive force attachment element and the vessel in a direction parallel to said normal to provide an "attractive force capacity reading" and

Page 11, please amend the paragraph beginning on line 9 as follows:

Accordingly in a further aspect the ~~present~~ invention ~~consists in~~ comprises a vessel mooring system which includes

Page 11, please amend the paragraph beginning on line 22 as follows:

(a) ~~a~~ means to measure the attractive force between the attractive force attachment element and the vessel to provide an "attractive force capacity reading" and

Page 13, please amend the paragraph beginning on line 17 as follows:

Accordingly in still a further aspect the ~~present~~ invention ~~consists in~~ comprises a vessel mooring system for controlling the mooring of a vessel with a wharf facility said system comprising:

Page 15, please amend the paragraph beginning on line 7 as follows:

Accordingly in still a further aspect the ~~present~~ invention ~~consists in~~ comprises a mooring system for releasably affixing a vessel floating at the surface at the surface of a body of water to a terminal which is secured to the bottom of said body of water wherein said vessel is subjected to loading forces resultant from any one or more of wind, tides, water currents, waves, vessel loading levels, and movement actuated by said system, said system including

Page 15, please amend the paragraph beginning on line 21 as follows:

~~a~~ means to determine the attractive holding force of said attractive force attachment element when said attractive force attachment element is in an attached relationship with said surface

Page 15, please amend the paragraph beginning on line 24 as follows:

~~a~~ means to determine the shear direction holding force of said attractive force attachment element with said surface when said attractive force attachment element is in an attached relationship with said surface, said shear direction holding force (herein after "horizontal shear direction holding force") being in a horizontal direction and perpendicular to said normal,

Page 15, please amend the paragraph beginning on line 29 as follows:

~~a~~ means to determine at least one or more selected from the group ~~comprising~~ consisting of

Page 16, please amend the paragraph beginning on line 25 as follows:

i. ~~a~~ means to establish and vary said attractive force, in a manner to increase said attractive holding force, and

Page 18, please amend the paragraph beginning on line 1 as follows:

Preferably said attractive force attachment is a variable attractive force attachment element wherein its attractive force may be varied by ~~a~~ the means to control the attractive force.

Page 18, please amend the paragraph beginning on line 24 as follows:

i. ~~a~~ means to establish and vary said attractive force, in a manner to increase said attractive holding force, and

Page 18, please amend the paragraph beginning on line 27 as follows:

Preferably said means to determine the horizontal shear force and/or tensile force includes ~~a~~ means to measure responsive to such force(s) and ~~a~~ means to read said means to measure said means to read providing a signal useable by said means allowing comparison

Page 19, please amend the paragraph beginning on line 1 as follows:

Preferably said means to determine the attractive holding force includes ~~a~~ means to measure responsive to such force and ~~a~~ means to read said means to measure said means to read providing a signal useable by said means allowing comparison.

Page 19, please amend the paragraph beginning on line 13 as follows:

Preferably said means to measure the said horizontal shear direction holding force means is ~~a~~ means to calculate such horizontal shear direction holding force from said measured attractive holding force.

Page 19, please amend the paragraph beginning on line 22 as follows:

Preferably wherein ~~a~~ means to measure the displacement of said attractive force attachment element relative to said base structure is provided.

Page 20, please amend the paragraph beginning on line 1 as follows:

Preferably the vacuum cups are likewise displaceable relative to the base structure in a horizontal and perpendicular direction to the normal and a control over the horizontal and perpendicular direction to the normal and a control over the horizontal shear force can be had by the acceleration/deceleration of the vacuum cup in the horizontal direction by ~~a~~ means to actively actuate the movement of the cups in the horizontal direction.

Page 20, please amend the paragraph beginning on line 10 as follows:

Preferably said means to measure said tensile and/or shear force includes a pressure transducer directly responsive to a respective hydraulic ram operating the control of the position of said vacuum cups in the direction of measurement by said pressure transducer being coupled to ~~he~~ the hydraulic pressure of said hydraulic ram.

Page 21, please amend the paragraph beginning on line 19 as follows:

Controlling the operation of a mooring system according to the method of certain embodiments improves ~~the present invention maximizes~~ its performance, reduces energy consumption and improves safety. By providing an alarm as capacity is approached, together with feedback of the capacity and the magnitude and direction of the applied loads, it allows the master of the vessel to take the most appropriate action to ensure the safety of the vessel in extreme conditions.

Page 21, please amend the paragraph beginning on line 25 as follows:

Where reference is made herein is made to a "direction" parallel to the direction ending to cause relative movement or separation, it is to be considered as being movement or measurement as appropriate in either generally the same direction or opposite direction.

Page 24, please amend the paragraph beginning on line 10 as follows:

The robots may for example be fixed to a front mooring face 112 and/or deck 11 of the dock. The mooring robot 100 of Figure 3 preferably includes at least one or one pair of vacuum cups or pads 1, 1' which are maintained substantially parallel to the plane of the front mooring face 112 for engagement with the hull of a vessel. In the most convenient form, the cups are to engage with vertically extending planar surfaces of a ship such as a port or starboard side hull surface. ~~The~~ In one embodiment the cups ~~are the means to~~ selectively provide an attractive force between the fixed structure of the robot and the surface with which it is to engage (eg the hull of the ship).

Page 24, please amend the paragraph beginning on line 19 as follows:

The mooring robot 100 is capable of positioning the vacuum cups 1, 1' in the three dimensions, referred to herein as "vertical", "longitudinal" and "athwartship", also corresponding to axes Y, Z, X respectively. "Longitudinal" refers to a direction generally perpendicular to the vertical axis and parallel to the longitudinal axis of the moored vessel or the front mooring face 112 of the dock.

Page 40, please amend the paragraph beginning on line 2 as follows:

With reference to Figures 19 to 21 there is shown an alternative configuration of mooring robot 100. The mooring robot in this example ~~consists of~~ comprises four vacuum pads 1 supported by a structure engaged to a wharf such as the front face 112 of the wharf and the deck 113 of the wharf. A vertical displacement carriage 81 is provided to mount the vacuum cups 1 from vertically extending rails 82 to allow the vacuum cups to travel in a vertical direction. A sub-carriage 83 is provided from the carriage 81 to allow the sub-carriage and hence the vacuum cups 1 to travel in a longitudinal direction and between the rails 82. Hydraulic rams and a supporting structure 84 are preferably provided to allow for the displacement of the cups 1 in an athwartship direction from both the carriage 81 and sub-carriage 83. Displacement of the vacuum cups 1 relative to the fixed structure of the of the mooring robot 100 as shown in Figures 19 to 21 is preferably provided in the athwartship direction by hydraulic rams. Likewise the movement in the longitudinal direction is provided by hydraulic rams. Movement in the vertical direction in this configuration may not necessarily be by hydraulic rams and may instead be by rack and pinion or similar arrangement to allow for the displacement of the vacuum cups in the vertical direction. The hydraulic rams to actuate the movement in the athwartship direction and in the longitudinal direction are preferably engaged to pressure transducers which (for the purposes and in a similar configuration as that described with reference to the mooring robot of Figure 3) allow for the determination of the forces applied by the ship to the mooring robot in the longitudinal and athwartship directions. Figures 22 to 24 show by the shaded region 180 the degree of freedom of movement that can be achieved by the mooring robot of this configuration to position the vacuum cups within the envelope 180.

Page 44, please amend the paragraph beginning on line 20, and continuing on page 45, as follows:

~~The system of the present invention provides~~ Thus, certain embodiments provide complete automation of the mooring process without requiring manual adjustment to be made involving human input. The system allows the measurement of the displacement of the ship when engaged with a mooring robot or robots to allow the determination of the distances moved from a pre-programmed reference position and thereby allowing such distances to be compared with user defined tolerances. The system provides for ~~a~~ means of counteracting the longitudinal and athwartship forces by the use of hydraulic actuators which can be actuated in response to information provided by the linear transducers to thereby revert the ship to its original position or to within a predefined displacement envelope. The system also provides for ~~a~~ means of actively guiding the ship into a pre-programmed position or a repositioning the ship to a different position. The ships may often be required to move along a wharf in relation to a shore ramp, bulk loading/discharge devices or container gantry cranes during their stay in port. The present invention allows for such displacement to occur and for full control over both the positioning and the degree of fastening of the ship with the mooring robots to be determined and maintained. Athwartship direction control and the vessel by the system of the present invention is also important for the purposes of keeping the hull away from fenders and other wharf structures thus reducing the contact damage which may result in paint abrasion and mechanical wear.